1/13/05-00666

Considerations for Risk Management of Arsenic in Groundwater at NAS Oceana SWMU 24

PREPARED FOR: NAS Oceana Project Management Team

PREPARED BY: Laura Cook/CH2M HILL

DATE: January 13, 2005

Purpose

The Navy is considering No Further Remedial Action Planned (NFRAP) and site closure under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at SWMU 24. Managing potential site groundwater risks is a key element in assessing NFRAP as the preferred remedy for SWMU 24. The following summarizes the site activities as related to a CERCLA release, associated potential groundwater risks, and provides rationale for risk management consideration. In consideration of Attachment (1), the recent *Statement to Tier I Teams*, Tier II is encouraging flexibility by the Project Management teams when assessing beneficial use and potability of groundwater and site-specific cleanup goals.

Site History

Contamination at SWMU 24 was identified during the 1988 RCRA Facility Assessment. Primary site contamination was caused by releases from a waste-oil bowser that was stored at the end of one of the buildings at the site. Waste solvents and oils generated at the equipment maintenance garage in Building 840 were routinely hand-carried and poured into the waste-oil bowser. The bowser, which was typically positioned in the southernmost corner of the SEABEE compound was periodically transported to the tank farm for disposal of the oil. The waste-oil bowser was removed from the site in 1992. Chlorinated volatile organic compound (CVOC) and polycyclic aromatic hydrocarbon (PAH) contamination identified during the 1993-1994 RCRA Facility Investigation , 1996 Corrective Measures Study, and subsequent groundwater monitoring is consistent with disposal of waste solvents and oils.

During the Phase I RCRA Facility Investigation conducted in 1993, two soil samples were collected from the stained soils in the area in which the bowser was parked. These soils were collected from 0.5 to 1.0 ft below ground surface. Soils were analyzed for total petroleum hydrocarbons (TPH), VOCs, PAHs, and metals. Analytical results indicated elevated TPH, VOC, and PAH constituents. The inorganic analyses performed at Site 24 detected metals that are naturally abundant in soils and some heavy metals at low concentrations, including arsenic, beryllium, chromium, vanadium, mercury, and nickel. The arsenic concentrations detected in these two samples were 1.1 mg/kg and 1.6 mg/kg compared to the residential and industrial soil RBCs of 0.43 mg/kg and 1.9 mg/kg respectively (October 2004 RBCs compared to 1993 data). Soil arsenic concentrations did not exceed the mean concentration in the Eastern United States estimated at 4.8 mg/kg. Consequently, the arsenic in soils was not determined to be site-related contamination. The Phase I RFI recommended additional soil sampling to determine the depth of soil contamination by TPH, PAH, and VOCs, and sampling of groundwater.

SWMU 24 soil and groundwater were also evaluated as part of the 1994 Corrective Measures Study for Petroleum Contaminated Sites. Six additional soil samples from six new locations were analyzed for TPH, PAHs, VOCs, and metals in order to evaluate the extent of contamination at the site. Arsenic concentrations in soils ranged from less than 0.3 mg/kg to 1.7 mg/kg. Arsenic concentrations in groundwater ranged from 9.4 ug/L to 349 ug/L. Arsenic in groundwater was theorized to be related to degradation of POL constituents as described in the next section, Arsenic and Site Geochemistry.

Based on TPH, VOC, and PAH sample results, an area of 3,200 square ft was recommended for excavation to a depth of 4 ft bgs. Additional soils contamination found during the excavation resulted in an expansion of the originally anticipated area of excavation. A total of 770 cubic yards of material was excavated from the site in 1994. The area of the excavation is shown on Figure 1. SWMU 24 was also recommended for further study due to TPH and VOC concentrations in groundwater. During additional sampling events conducted as part of the 1995 Phase II RFI, the 1996 Corrective Measures Study (CMS), and monitoring of the 1997 NoVOCs pilot test, the primary contaminants of concern identified at SWMU 24 were trichloroethene, 1,2 dichloroethene (1,2 DCE), vinyl chloride and benzene. Fingerprint total petroleum results for the petroleum product present at the site were indicative of diesel fuel. No other fuel types were identified (CH2M HILL, April 1997). Chorinated VOCs (CVOCs) were present in a distinct plume as shown on Figure 1. Plume migration was consistent with groundwater flow direction (Figure 2).

In 1996, the NoVOCs pilot study was implemented at the site. This treatment method involves in-well air stripping to remove VOCs from groundwater. The treatment well for the pilot study was installed just southeast of OW24-MW01 in the previous location of the oil bowser. Concentrations of VOCs were significantly reduced during the pilot study. Groundwater sampling results from 1999 indicate that CVOC concentrations had been reduced to below MCLs in all but three monitoring wells and piezometers at the SWMU. The results of this groundwater investigation and subsurface soil samples collected following the removal action were used to complete the January 2001 Human Health Risk Assessment (HHRA), CH2M HILL, January 2001. The three wells with CVOC exceedances of MCLs were targeted for additional remediation using enhanced aerobic biodegredation technology, but the baseline round of sampling for that remediation project conducted in 2003 indicated that the CVOC concentrations had naturally attenuated to concentrations which no longer present an unacceptable risk to human health. Based on this information, one can conclude that the residual effects of the pilot test have continued.

The Navy submitted the no further response action planned (NFRAP) Proposed Plan (PP) and Decision Document (DD) for SWMUs 1 and 24 in June 2004. The Navy proposed that the remaining site contaminants (arsenic in groundwater) were the result of petroleum products known to have been released at these sites as "waste oil" and thereby should be exempt from further action under the CERCLA program. The Navy further had proposed that any additional actions at these SWMUs would be addressed under the State's underground storage tank (UST) program, which addresses primarily petroleum-oil-lubricants (POL) compounds. Upon receipt of the EPA's comments on the draft documents, the NAS Oceana project management team (PMT) held a conference call to discuss the applicability of the CERCLA petroleum exclusion to the disposal of waste oil at SWMU 24. During this September 8, 2004 call, the Navy, EPA, and DEQ discussed the applicability of the POL exclusion under the CERCLA program for SWMU 24. It was determined that the POL exclusion does not apply at this SWMU. Therefore, the team agreed that the Navy would re-evaluate the arsenic contamination in the groundwater at SWMU 24. The Navy redeveloped the monitoring wells at SWMU 24 and sampled those monitoring wells and background monitoring wells for target metals only (total and dissolved). Wells were redeveloped because they had not been sampled for an extended period of time. The new data was used to reevaluate the risk posed by arsenic at SWMU 24. Total and dissolved concentrations from the November 2004 sampling event are shown on Figure 3. The average SWMU 24 total and dissolved arsenic concentrations for this round of sampling are 20 ug/L and 13 ug/L respectively.

Arsenic and Site Geochemistry

A common cause of elevated arsenic under reducing conditions is the release of naturally occurring arsenic from iron oxides. This occurs when iron oxide reacts with organic carbon and is common in sites contaminated with POL and VOC contamination. (Welch, A.H., Westjohn, D.B., Helsel, D.R. and Wanty, R.B., 2000. Arsenic in ground water of the United States: Occurrence and geochemistry. Ground Water 38(4) 589-604.)

Additionally, in a highly reducing environment, elemental arsenic and arsine in the –3 valence state are the most prevalent forms of arsenic wheras under mildly reducing conditions arsenite (+3) is the dominant form. Arsenate (+5) is formed in oxidizing conditions (http://www.inchem.org/documents/ehc/ehc/ehc224.htm#1.2). Sorption of As(+5) onto soil particles is more favorable than that of As(+3) at mildly acidic pH values (5-6) such as those present at SWMU 24 (Environmental Science and Technology. 2003 Sep 15;37(18):4182-9).

Reducing conditions that may have existed due to POL degradation have been eliminated at most site wells due to the NoVOCs pilot test. Oxidation/Reduction potentials (ORP) can be used to determine whether conditions are oxidizing or reducing. During the November 2004 sampling round all ORP values were positive (indicating oxidizing conditions) with the exception of OW24-MW01. The highest concentration of arsenic detected during the Nov 2004 sampling round was from this well. ORP values are shown in Table 1.

Table 1
Oxidation/Reduction Potential Nov. 2004

Well ID	ORP Nov 2004
OW24-MW01	-20
OW24-MW02	75
OW24-MW03	145
OW24-MW04	94
OW24-MW05	143
OW24-MW06	94
OW24-MW08	194
OW24-MW09	85
OW24-MW10	49
OW24-MW11	143
OW24-PZ01S	116
OW24-PZ02S	49
OW24-PZ03S	58

Mean arsenic concentrations of Geoprobe groundwater data collected prior to implementation of the NoVOCs pilot test were 107.8 ug/L (total) and 123.2 ug/L (dissolved) compared to mean concentrations of 20 ug/L and 13 ug/L during the most recent sampling event. This indicates that groundwater arsenic concentrations are decreasing as a result of the oxidizing conditions now present at SWMU 24. Background ORP values measured during collection of background arsenic samples indicate positive ORP values in background wells (average of 161). Consequently, it is likely that infiltration of background water will eventually result in increasingly oxidizing conditions.

Summary of Groundwater Risks

In accordance with the NAS Oceana Project Mangement Team's conference call on September 8, 2004 the monitoring wells at SWMU 24 were redeveloped and sampled for arsenic only (total and dissolved). The new data set was assessed to determine the risk posed by arsenic to the potential future resident and construction worker receptors coming in contact with arsenic in groundwater. Risks to receptors exposed to arsenic in groundwater were calculated using reasonable maximum exposure (RME) and central tendancy exposure (CTE) estimates. In addition, the potential risks posed to receptors coming in contact with arsenic in groundwater at the federal MCL levels (10 ug/L) were also calculated.

Potential risks to future receptors based on reasonable maximum exposure (RME) estimates, from potable use of groundwater are summarized in Table 2. Potential cancer risks (RME) to the age-adjusted resident coming in contact with arsenic in groundwater (total and dissolved) were calculated to be $2.6x10^{-03}$ and $1.5x10^{-03}$, respectively, which were above the USEPA's acceptable carcinogenic risk range (10^{-4} to 10^{-6}). The concentrations of arsenic in filtered and unfiltered samples were 120 ug/L and 66 ug/L, respectively. Similarly, the non-cancer hazard indices (RME) calculated for the future adult and child residents exposed to total (adult HI = 25.1; child HI = 10.3) and dissolved (adult HI = 6.1; child = 14.2) arsenic in groundwater were also above the USEPA's acceptable level of 1.0 (Table 2) . Potential cancer risks to the future age-adjusted resident from potable use of groundwater based on CTE assumptions (20 ug/L for total arsenic, 13 ug/L for dissolved) were calculated to be $1.3x10^{-4}$ and $8.3x10^{-5}$, respectively, which were slightly above (total) and within (dissolved) the USEPA's acceptable risk range of 10^{-4} to 10^{-6} for cancer (Table 2). Non-cancer hazard indices for the child resident exposed to total (HI = 2.1) and dissolved (HI = 1.3) arsenic in groundwater are only slightly above USEPA's acceptable non-cancer hazard index of 1 and are comparable to the non-carcinogenic risks to these receptors exposed to arsenic in groundwater at the MCL (HI=1.1) levels of 10 ug/L. The arsenic concentrations at SWMU 24 do not pose any unacceptable cancer (total= $6.5x10^{-07}$; dissolved = $3.7x10^{-07}$) or non-cancer (total = 0.1 and dissolved = 0.057) risks, to a future construction worker at RME exposure assumptions. Similarly arsenic cancer (total= $9.5x10^{-08}$; dissolved = $6.1x10^{-08}$) or non-cancer (total = 0.015 and dissolved = 0.01) risks, to a future construction worker at CTE exposure assumptions are also below USEPA's acceptable cancer risks and non-cancer HI (Table 2).

Table 2
Summary of Site Arsenic Risks

Risk	Exposure assumptions	Sample Preparation	Future Adult Resident	Future Child Resident	Future age-adjusted (adult/child) resident	Future Construction Worker
Cancer	RME	Total	NA	NA	2.6e-3	6.5e-7
Cancer	RME	Dissolved	NA	NA	1.5e-3	3.7e-7
Cancer	RME	MCL	NA	NA	2.3e-4	5.5e-8
Cancer	CTE	Total	NA	NA	1.3E-4	9.5E-8
Cancer	CTE	Dissolved	NA	NA	8.3E-5	6.1E-8
Cancer	CTE	MCL	NA	NA	6.6E-5	4.8E-8
Non-cancer	RME	Total	10.3	25.1	NA	0.1
Non-Cancer	RME	Dissolved	6.1	14.2	NA	0.057
Non-Cancer	RME	MCL	0.92	2.1	NA	0.086
Non-Cancer	CTE	Total	0.84	2.1	NA	0.015
Non-Cancer	CTE	Dissolved	0.54	1.3	NA	0.01
Non-Cancer	CTE	MCL	0.43	1.1	NA	0.0075

Total and dissolved CTE concentrations used were 20 ug/L and 13 ug/L respectively
Total and dissolved RME concentrations used were 120 ug/L and 66 ug/L respectively
Risks are calculated based on total risk including risk due to ingestion, dermal contact, and inhalation

Another round of background data (arsenic only, total and dissolved) was collected. However, as this data is consistent with the initial background data sets, in which arsenic was only present in low concentrations, well below the MCL. Therefore, the risk attributable to the background upper confidence limit (UCL) was not calculated.

Rationale for Risk Management Consideration

No Discernable Plume

The CVOCs from the CERCLA release at SWMU 24 were in a localized plume, with the highest concentration at the former source area (oil boswer) and plume migration occurred along the hydraulic gradient (Figure 2). This expected pattern of the known CERCLA contaminants is not consistent with the distribution of arsenic at SWMU 24. The highest concentration of arsenic (OW24-MW01) is located at the former source, yet monitoring points at 30-ft and 60-ft downgradient (OW24-PZ01S and OW24-PZ02S, respectively) have no detected concentration of arsenic. Although monitioring location OW24-PZ03S (90-ft downgradient of OW24-MW01) has arsenic exceeding the MCL, this concentration is consistent within an order of magnitude with concentrations detected in upgradient (OW24-MW06, OW24-MW10, and OW24-MW11) and sidegradient (OW24-MW04) monitoring wells. Because of this inconsistent arsenic distribution (i.e. no discernable arsenic plume), the arsenic detected at SWMU 24 may not be related to the CERCLA release.

Arsenic Concentrations under Oxidizing Conditions

Since arsenic in groundwater may be elevated under reducing conditions due to release from iron oxides and decreased ability of iron to sorb to soil particles, it is likely that natural arsenic was released due to previous POL and organic contamination. As oxidizing conditions now exist at SWMU 24, it is anticipated that arsenic concentrations will decrease over time. This decrease is evidenced by the reduction in average total and dissolved concentrations from 1993 (107.8 ug/L and 123.2 ug/L respectively), 1998 (34.1 ug/L and 32.2 ug/L respectively) and 2004 (20 ug/L and 13 ug/L respectively).

Summary of Site Arsenic Risk

Although, the potable use of the shallow groundwater does pose an unacceptable non-cancer risk to the future child resident based on central tendency exposure estimates for total and dissolved arsenic in groundwater, these non-cancer HI's are similar to those calculated for arsenic at the federal MCL level. Similarly, the carcinogic risk (CTE) calculated for the future age-adjusted resident exposed to total and dissolved arsenic in groundwater is either slightly above (total) or similar to (dissolved) cancer risks posed by exposure of this receptor (age-adjusted resident) to arsenic at the federal MCL concentration.

The arsenic concentrations at SWMU 24 do not pose any unacceptable risk to a future construction worker.

Compounding Factors for Risk Management Consideration

NAS Oceana is the only remaining master jet base on the East Coast; SWMU 24 is in an industrialized portion of the installation. It is highly unlikely that SWMU will be utilized for residential development.

Summary

The proposed remedial action for SWMU 24 is NFRAP based on source removal of contaminated soils with waste oil (1995), the reduction of CVOCs through the in-well aeration pilot project (1996/7) and subsequent degradation, and considering risk management of arsenic in groundwater. In the context of this proposed remedy the localized elevated arsenic in groundwater at SWMU 24 warrants risk management consideration for for the following reasons:

- There is no discernable arsenic plume at SWMU 24. The inconsistent arsenic distribution detected and the absence of elevated arsenic concentrations in soil samples indicates that the arsenic may not be related to the CERCLA release of waste oil (vehicle maintainence fluids containing CVOCs).
- Elevated arsenic may have resulted from reducing conditions previously existing at SWMU 24 as a result of POL degredation. These conditions no longer exist at the SWMU 24, and based on sampling data, arsenic concentrations are declining.
- Potential non-cancer risk to future child resident based on central tendency exposure assumptions from potable use of groundwater is comparable to the risk posed by exposure to arsenic at the MCL concentration.
- Potential cancer risk to future age-adjusted resident based on central tendency exposure assumptions from potable use of groundwater is comparable to the risk posed by exposure to arsenic at the MCL concentration.
- The arsenic concentrations at SWMU 24 do not pose any unacceptable risk to a future construction worker.
- Although it is unlikely that SWMU 24 will be developed for residential use, the availability of potable water within this vicinity further reduces the potential that groundwater from the site would ever be used as potable water.

File Path: V:\18gis\Oceana\Figures\swmu24.apr

LEGEND
- SWMU Boundary
- Area of Soil Excavation
- 1,2-DCE Isocontour (ug/L) February 1994 to March 1995
- Monitoring Well
- Piezometer

N

0 75 150 Feet

Figure 1
Previous Groundwater Plume
and Area of Soil Excavation Map
NAS Oceana
Virginia Beach, Virginia

CH2MHILL

00666D014

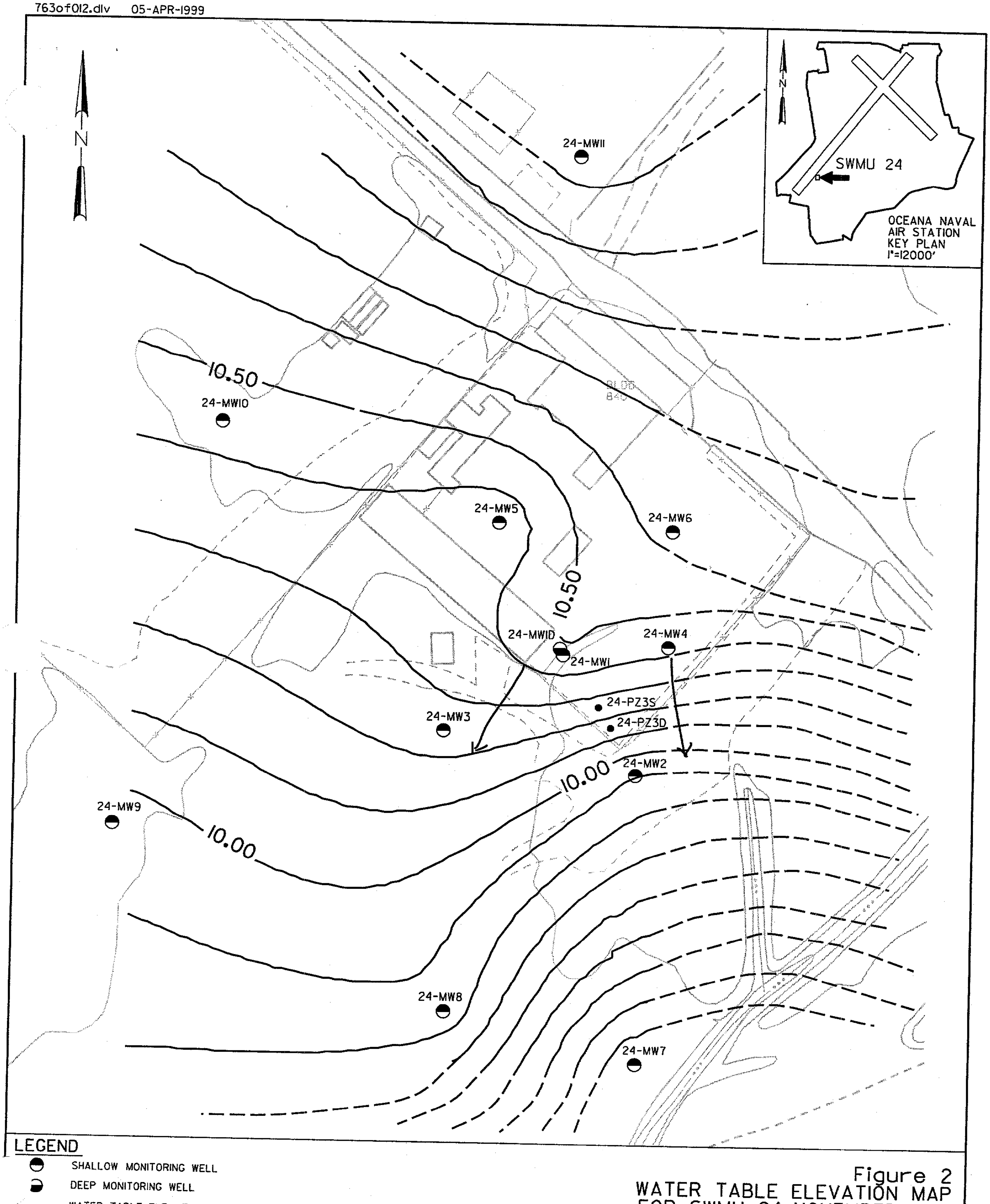

Figure 2
WATER TABLE ELEVATION MAP FOR SWMU 24-NOVEMBER 1998

Naval Air Station, Oceana
Virginia Beach, Virginia

CH2MHILL

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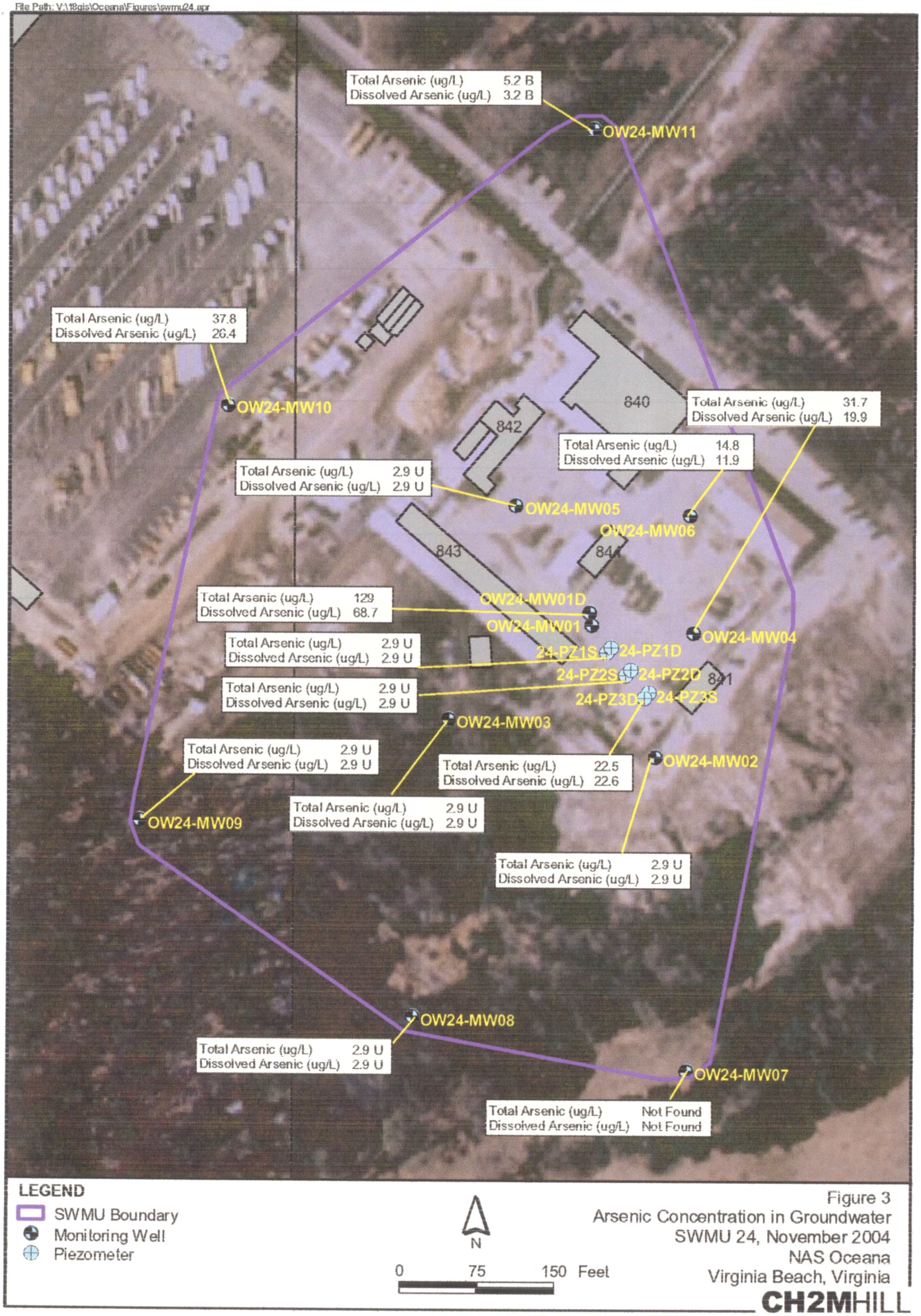

Figure 3
Arsenic Concentration in Groundwater
SWMU 24, November 2004
NAS Oceana
Virginia Beach, Virginia

CH2MHILL

00666 D 024

Attachment 1

-----Original Message-----
From: Doug.Dronfield@CH2M.com [mailto:Doug.Dronfield@CH2M.com]
Sent: Wednesday, January 05, 2005 17:31
To: smeckerk@ttnus.com; Gutberlet, Andrew D. CIV NAVFAC; Mayer, Ryan CIV NAVFAC Washington; Paul.Landin@CH2M.com; Caldwell.donna@CH2M.com; franklin.greyson@epamail.epa.gov; kim.henderson@CH2M.com; Johnson, Winoma A CIV NAVFAC MidLant
Cc: Bullard, William CIV CNRMA Env; Neillch@pwcnorva.navy.mil; driscoll.stacie@epa.gov; frizzellb@nt.quantico.usmc.mil; Gilbertson, Paula CIV NAVFAC WASHINGTON; Schirmer, Robert G CIV NAVFAC Lant; stephens.mark@epa.gov; dhwillis@deq.state.va.us
Subject: GW Message to Tier 1 Teams

Tier 1 POCs, here is a message from the Tier 2 for the GW and MCL issue that many people have been working on this past year. Please distribute to your team. Thanks

Va Tier I teams,

There have been ongoing concerns on how to address groundwater in the context of use as a drinking water source. The Navy, EPA & VDEQ have agreed to various options on how groundwater can be addressed by the Navy's IR program in the Commonwealth of Virginia. It is attached as "Statement to Tier I teams, dated December 6, 2004" (see e-mail message from Robert Weld below). Teams should incorporate sound science, along with risk management, when addressing groundwater issues at your IR site. This "Statement" is intended for decisions regarding drinking water issues and should not preclude teams from investigating and addressing other pathways/exposure scenarios when contaminants of concern are present.

The flexibilities in the attachment are in accordance with the NCP. It is our expectation that these flexibilities be used as part of the overall site assessment to create lines of evidence to document the team's groundwater decision. No attempts should be made to shortcut to a no action ROD by simply saying that the groundwater is not potable. The number of flexibilities applied will depend on site-specific conditions/data, etc. In some scenarios one may be sufficient to support the team's groundwater decision while in others, a combination of flexibilities may be appropriate.

Since the Tier I teams are the decision makers, each Tier I teams will differ on the amount of documentation they require to be comfortable in making a risk management decisions. Therefore, each partnering team should review these flexibilities and decide how they will incorporate this information into their groundwater decision making process.

Message from Robert Weld:

Tier II Members,

I am sending you this e-mail on behalf of Paul Yaroschak, Hank Sokolowski, and myself. As you are aware the issue of beneficial use of Groundwater in Virginia has been the subject of many discussions between the Navy, EPA, and DEQ over the last year or so. Several of you have been involved in these discussions and have been instrumental in reaching the current consensus on this issue. The purpose of this e-mail is to rollout the Final Statement to Tier I Teams designed to assist the teams in the assessment of beneficial use, groundwater potability, and/or cleanup goals for Navy ERP sites undergoing evaluation in accordance with CERCLA .

The following are the principles by which the Statement was based and should be conveyed to Tier 1 (by the Tier II members) when providing the
Statement:

1) Virginia's groundwater classification system or lack
thereof
will not be challenged by the Navy.

2) No attempts will be made to short cut to a no-action ROD
by
simply saying that groundwater is not potable.

3) EPA/Virginia will not press for active remedies (See
Timeframes
discussion in the attachment) where the water is not currently being used for potable purposes or anticipated to be used for potable purposes in the near future.

4) EPA, the Navy and Virginia will seek to use various methodologies (provided in the attached Statement) and criteria
(e.g. -
background) in order to explain the logic and arrive at a common-sense ROD for each site. Any decision on GW must follow the proper process and technical analysis before a decision is reached, including no action. Site-specific conditions and available data will determine which of the methodologies best apply. In some cases, only one may be necessary where as in others, a combination of methodologies will be employed.

We hope that both the Navy Tier II and Tier I teams find this information valuable and we appreciate everyone's patience while the parties reached agreement on some of the key policy issues necessary to develop this paper. If you have any questions, please feel free to contact Paul, Hank, or myself.

Sincerely,

Robert Weld

Robert J. Weld
Director, Office of Remediation Programs
Virginia Department of Environmental Quality
804-698-4227

Statement to Tier 1 Teams December 6, 2004

In cases where teams may be working to assess beneficial use, groundwater potability and/or cleanup goals, there are flexibilities in the process that can be used by each team to develop a strategy in accordance with CERCLA, the NCP and site specific conditions to reach a mutually agreeable solution. It is our expectation that the appropriate technical experts will be brought in to participate in discussions early on to help identify which flexibilities may be appropriate to explore. These flexibilities can be used as part of the overall site assessment process to create lines of evidence that serve as documentation for beneficial use, ground water potability, and/or cleanup goals. The teams will determine the specific site appropriate flexibilities that should be used (number and type) that form the lines of evidence.

Flexibilities may include but are not limited to:

- Background: In many cases, inorganics may be attributable to background conditions. A background assessment can prove to be invaluable to determining whether or not a contaminant is site-related.

- Risk-Range: There is flexibility in determining whether an action needs to be taken as long as the site-related cancer risk falls within EPA's acceptable risk-range (1×10^{-6} to 1×10^{-4} and Hazard Index of 1).

- Source removal/containment & monitoring: Another option to explore if there is not a current user. If the contamination in the groundwater is representative of what is being found in the soils, soil removal and monitoring may be warranted to determine if source removal alone will result in a reduction of contaminant levels in the groundwater.

- Timeframes: Depending on the current use of the groundwater the amount of time needed to reach cleanup goals may be flexible. For example, if groundwater is not currently being used as a drinking water source, and it is not expected to be used as such in the near future, cleanup technologies that may take longer to achieve cleanup goals could be considered. Monitored Natural Attenuation (MNA) is an example. MNA may be used in certain situations when: the processes will allow ARARs to be met in a timeframe comparable to a more active remedy. (NCP Preamble, 55 Fed. Reg. 8734). Additional EPA Guidance is available: *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, 1999. This guidance clarifies that MNA may be used when there is a low potential for plume migration, and when sources have been controlled.

  When evaluating remedial actions that require extended timeframes, additional factors may be considered that lend support to the Timeframe flexibility. For example, existing ground water controls, regulations, ordinances, etc., can be used to demonstrate that current restrictions are in place to manage water usage until the remedial action is complete.

- Is it a Plume? (Consistent/Contiguous): There may be instances where data from one well is driving the site-related risk. A close review of data will help determine whether there truly is a plume or not.

- Sample representativeness: It may be beneficial to review historical data to determine if proper well installation and sampling methodology occurred and verify the current conditions of the wells to ensure that sampling of the wells will generate representative samples.

- Classification: Guidance for assessing groundwater uses is provided in the Preamble to the 1990 NCP Revision (55 Fed Reg. 8666 et seq. (March 1990); recommending that EPA's 1984 "Ground-Water Protection Strategy" and 1986 "Guidelines for Ground-Water Classification" be used to assess future use of ground waters at a particular site.

- Alternate Concentration Limits (ACLs): (only when active restoration to ARARs is not practicable (from the nine criteria analysis). This is not the engineering practicability as used for TI determination.

  CERCLA Section 121(d)(2)(B)(ii) and NCP Section 300.430(e)(2)(i)(F) also allow for the use of Alternate Concentration Limits (ACLS):
  - there are known and projected points of groundwater entry into surface water
  - there are no statistically significant increases in contaminant levels downstream or at any place where contamination is expected to accumulate; and
  - enforceable measures can be taken to prevent human exposure between site and the entry points in surface water

- Technical Impracticability (TI): If from an engineering perspective, it is technically impracticable to comply with an applicable, relevant and/or appropriate requirement (ARAR) (such as meeting MCLs), a TI Waiver may be prepared. EPA's "Guidance for Evaluating the Technical Impracticability of Groundwater Restoration" can be utilized to prepare the supporting TI Waiver documentation.